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ABSTRACT

A comparative analysis of the oral reading miscues of 20 average and above-average readers entering sixth grade was made in relation to syntax, semantics, and patterns of comprehension and grammatical relationships. Miscues generated while reading passages in science, social studies, mathematics, and literature were analyzed, and the relationship between the syntactic complexity of the passages and the subject's retellings was determined using ANOVA procedures. No significant differences were found among the miscues from the different passages, and readers did not retell passages at significantly higher levels of syntactic complexity than allowed by their comprehension. The data did not support the assumptive differences attributed to reading in various content areas. The findings suggested that the reading process remains stable across passages from various subject areas. (HTH)

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A COMPARATIVE ANALYSIS OF MISCUES IN CONTENT AREA READING

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A Comparative Analysis of Miscues
in Content Area Reading

Researchers have investigated the problems of textbook readability in various content-subject areas and conclude typically that complex language patterns, especially in regard to vocabulary, abstraction, symbolization, concept load, and format are responsible for making reading difficult. Such factors are assumed to interfere with a reader's ability to comprehend written material and even though the student may have some mastery of reading skills, the content area textbook may be more of a hindrance than a help.

The influencial research and writings of Nila Banton Smith during the early and mid-1960's spurred numerous reading specialists to discuss at length the factors contributing to reading difficulties in content areas. Smith's (1964) comprehensive study of textbooks identified three important requirements needed to read materials in different subject areas. The first includes those basic reading skills common to all types of reading: word recognition, comprehension, and so forth. The second includes those specialized skills utilized "in study situations over, above, and in addition to the common reading skills employed in non-study situations" (p. 32). The third requirement, and the focus of the investigation, is attention to the specific patterns of writing in different subject areas. Smith writes:

> The cue for an analysis of textbook content in science, social studies, and mathematics arose

> from an awareness of different patterns of writing in literature. It was hypothesized that there might also be special patterns of writing in the content of other subject fields. (p. 31)

Smith explains that if this hypothesis is true, teachers could help students to read content materials in light of the identified patterns.

Similar difficulty factors have been identified by others. Whereas Smith labels these factors as variations in "patterns of writing," most researchers simply explain them as specialized skills needed to read in different content areas. Dechant's (1970) statement is typical of the professional writing on subject matter reading:

> It is no longer possible to hold that all reading skills will transfer from one field to another. Reading is not a generalized ability that the pupil learns once and for all time. Rather, reading is a composite of many skills, each varying with the situation. (p. 440)

When analyzing the writing found in subject areas, however, it becomes difficult to label a particular passage as representative of a specific pattern of writing. The difficulty of such materials is compounded by shifts in writing patterns and the use of several patterns in combination. Smith's patterns of writing, therefore, are not completely analogous to the stylistic forms found in literature. Furthermore, most research is "concerned with measuring the results of the reading process after reading subject material rather

than studying the reading process as it is applied by individual readers" (Carlson, 1975, p. 53).

In a newer approach to content reading, Carlson (1970) focused on the process readers used as they read various subject matter. Carlson analyzed the oral reading miscues of readers as they read two selections from three different types of contextual material: basal reader, science, and social studies. Although the level of miscue involvement was fairly consistent in all passages, Carlson found that the ratio of non-correction to correction of miscues was higher in science and social studies than in basal readers. The study revealed that the majority of miscues in all selections show a high degree of partial or full syntactic acceptability and have the same grammatical function as the expected text response. All readers made extensive use of syntactic and semantic cues to gain meaning, regardless of content area.

Carlson (1975) notes that previous writings on content area reading "have assumed that readers need to shift their modus operandi when reading different subject matter" (p. 55). Because of the nature and purpose of content materials, significant improvement in the readability of these textbooks through the elimination or modification of difficult vocabulary and concepts, for example, does not appear realistic or promising. Perhaps the most practical alternative would be to examine the nature of the reader's attempt to gain meaning from the material and to develop instructional strategies based upon demonstrated strengths and weaknesses in a

comprehension-centered approach.

Purpose

The Reading Miscue Inventory (RMI) was used to analyze the oral reading miscues of average readers in their encounter with the language patterns found in four content areas: science, social studies, mathematics, and literature. The focus was upon the reader's use of the syntactic and semantic cueing systems in an effort to gain meaning from the different passages. The following hypotheses were tested: results of the RMI will show no significant difference in the number of acceptable grammatical function miscues, miscues corrected, grammatically acceptable miscues, semantically acceptable miscues, and miscues which do not alter meaning of content occurring among the selected passages of science, social studies, mathematics, and literature. Furthermore, the results will show no significant difference in the total number of miscues, comprehension profiles, and grammatical relationship profiles. The level of rejection for the null hypotheses was equal to or less than $p = .05$

An analysis of each subject's oral reading miscues and subsequent retelling was used to answer the following questions:

1. What is the relationship between the syntactic complexity of the subjects' initial retelling and the syntactic complexity of the passages?

2. What is the relationship between miscues that result in a change of meaning and the subjects' abstract "dictionary" of lexical items? Do the subjects demonstrate any evidence of having the expected text item (the item that generated the observed miscue) in memory storage?

Significance

The significance of this investigation is threefold. First, an examination of oral reading patterns, particularly the use of syntactic and semantic cues, adds to the theoretical knowledge of reading as a psycholinguistic phenomenon. In essence, the study attempted to expand the psycholinguistic theory by challenging previous assumptions found in the literature on reading in the content areas. The hypotheses tested were stated in the null form: results of the RMI will show no significant differences in the syntactic and semantic strengths of the readers. Failure to reject these null hypotheses adds further credence to the theory and research related to the psycholinguistic nature of reading and thereby expands the existing data especially in regard to the four content areas.

Second, this study attempted to extend the range of the RMI as an instrument for research into the nature of reading. Since the RMI is based upon a psycholinguistic theory, this investigation also refines the theoretical assumptions that underlie its power as a research tool. The RMI was used as a dependent measure of comprehension, resulting in a quantitative and a qualitative analysis of oral reading.

Third, the analysis of miscues made by subjects during their oral reading of passages from science, social studies, mathematics, and literature provides insight into the complex language patterns found within the textbooks of these content areas. The resulting analysis provides some indication of how the language of the reading materials could possibly cause miscues and interfere with comprehension and academic

learning. Rejection of the hypotheses lends sypport to the assumption that the reading process varies according to the content of reading materials. Failure to reject the hypotheses, however, lends further support to the underlying theory of reading as well as the stability of the process across varying content materials.

Method

Subjects

Twenty subjects entering the sixth grade were selected. All subjects were average or above-average readers as confirmed by standardized test scores on school permanent records and by teacher recommendation. The above criteria were used in selecting the stratified sample and final verification of subject eligibility was made by the investigator. No attempt was made to control the variability among subjects in regard to school of attendance, method of reading instructions, sex, race, or socio-economic level.

Passages

Specialists in each of the four areas were asked to compile a bibliography of textbooks deemed representative of the resources available within each area. Several sixth-grade textbooks were then examined in order that passages be selected according to the requirements dictated by the RMI (source, interest, complexity, format, and potential for generating miscues). Passages were controlled for readability using the Fry (1968) Readability Graph. Passages approximately one year above the expected reading ability of the students in the sample were used.

Passages were characteristic of the materials typically encountered in the public school curriculum. To permit broader generalizations about the textbooks found within the areas studied, four passages were selected in each of the four areas. Out of a pool of passages, those used in the study were randomly selected to insure that all passages had an equal probability of being included and that the selection of one had no influence on the selection of any other. Passages were uniformly prepared, avoiding any extraneous variables that may have interferred with continuous reading.

Collection of Data

Each of the four passages was read on a separate day to avoid possible fatigue factors. Randomization was used to control for an ordering factor that could nullify the final analysis of the data. First, only one passage from each area was randomly assigned to each subject. Secondly, each subject read the passages from the four areas in randomized order.

Once the subject began to read the passage, the session continued without interruption. No help, support, or reaction were given by the experimenter. After the reading was completed, the passage was removed and the retelling began. Again, this portion proceeded without interruption until the subject had responded satisfactorily.

Analysis of Data

Each tape and corresponding worksheet was reviewed several times in order to arrive at an accurate miscue inventory.

A separate RMI Coding Sheet was completed for each passage read by each subject and a comparative analysis was made of the miscues in the four content areas in relation to questions five through nine of the RMI and the comprehension and grammatical relationship patterns. Attention was given to the "strengths" of each reader as indicated by checking the appropriate columns on the RMI Coding Sheet.

The Friedman test, a two-way analysis of variance by ranks, was used to test the null hypotheses of the study. The data were cast in a two-way table having twenty rows representing the sample population and four columns representing the selected passages from each content area. The Friedman statis, X_r^2, determines whether the distribution of ranked scores in each column is a matter of chance or is independent of the conditions under which the scores occur (Siegel, 1956, p. 168). The region of rejection for H_o was equal to or less than $p = .05$.

Measurement of syntactic relationships. Hunt's (1965) procedure was utilized to determine the syntactic relationship between the passages of the four content areas and the initial retelling by the subjects. This involved counting the total number of T-units and calculating the mean word length per T-unit for both the passages and the retelling. For each of the sixteen passages, the first-, third-, and fifth-hundred words were used to calculate the mean number of T-units and mean length of T-units. The means for the four areas were used in the final analysis, rather than those found for each separate passage.

A similar procedure was followed in determining the syntactic complexity of the initial retelling of the passages. Typewritten transcriptions of audio tapes were marked according to procedures described by O'Donnell, Griffin, and Norris (1967). Only the initial retelling of each subject was used so to avoid any influences that experimenter questioning or discussion may have had upon the subject's free response. The mean number of T-units and the mean length per T-unit were calculated for all subjects within each of the four content areas.

A repeated-measures analysis of variance was then used to determine any differences among the initial retellings for the four areas. The analysis of variance was computed for both total number of T-units and mean number of words per T-unit. Deviation scores were used to calculate both analyses in order to account for differences in the retellings that may have occurred as a result of differences in the syntactic complexity among the selected passages. When the analysis of variance resulted in a significant F-value, the Newman-Keuls method of multiple comparisons was computed.

In addition, eight separate t-tests were computed to determine whether the differences between the passages and the initial retellings were significant with regard to total number of T-units and mean number of words per T-unit. Since the purpose of this test is to determine the difference between two means (passages versus retellings), it was calculated by using the standard mean for each content area and the mean for all subjects for each of the eight comparisons.

Semantic analysis. The single most important question of the RMI deals with "how much the message of the text is altered by the reader's miscues" (Goodman & Burke, 1972, p. 61). If there is no change in meaning, the "N" column is checked. A certain number of miscues did result in a change of the author's intended meaning. The semantic aspect of the study sought to determine the percentage of "meaning change" miscues that were later used correctly in the subject's initial retelling. If the subject did not use the miscue in correct form during the retelling, the examiner tried to elicit the intended message (textual item) during the questioning session. The percentage of miscues used, defined, or described as intended by the author during this period is reported. These two percentages provide indication of the subjects having the expected text item in their memory storage.

Results

The following findings were evident:

A. No significant differences were found among the selected passages of literature, mathematics, science, and social studies as shown by the results of the RMI with regard to:

H_1 the number of acceptable grammatical function miscues $X_r^2 = 6.27$

H_2 the number of miscues corrected $X_r^2 = 6.76$

H_3 the number of grammatically acceptable miscues $X_r^2 = 4.81$

H_4 the number of semantically acceptable miscues $X_r^2 = .2.35$

H_5 the number of miscues which do not alter meaning of content $X_r^2 = 5.62$

H_6 the total number of miscues $X_r^2 = 6.61$

H_7 the comprehension pattern $X_r^2 = 6.89$

H_8 the grammatical relationship pattern $X_r^2 = 2.25$

B. No significant differences were found among the retellings of the literature, mathematics, science, and social studies passages with regard to the mean number of words per T-unit. Table 1 presents the results of the ANOVA for mean words per T-unit among the retellings. The F-value of 1.399 is less than the critical value for the established level of significance.

Table 1 about here.

C. Table 2 shows the results of the ANOVA for the number of T-units contained within each subject's initial retelling. Since the F-value of 33.579 with d.f. of 3 and 57 is significant at the .05 level, it was concluded that there is a significant difference among the number of T-units among the retellings of the four passages.

Table 2 about here.

D. Since the F-statistic of 33.579 is significant at the .05 level, the Newman-Keuls test of multiple comparisons was made. The results of the procedure using deviation scores between the subjects' mean number of T-units and the mean number of T-units found among the passages

within each area indicate significant differences for all comparisons except for science and mathematics. The deviation scores for science and mathematics did not differ significantly with regard to the number of T-units found in the retellings.

E. Table 3 summarizes the data used to calculate the *t*-statistic for the mean number of words per T-unit in the passages and the retellings for each area. No significant differences were found between the retellings and the passages with regard to the number of words per T-unit for science, social studies, and mathematics. A significant difference was found between the passages and the retellings for literature with regard to the number of words per T-unit.

Table 3 about here.

F. Table 3 also shows significant differences found between the mean number of T-units in the passages and the mean number of T-units in the retellings for all four content areas.

G. Table 4 shows that the greatest number of meaning change miscues occurred during the reading of mathematics while the least number occurred within the reading of the literature passages. The total number of expected text items used during the initial retelling and questioning sessions ranged from 8.17 percent for social studies to 13.84 percent for literature. Out of a total of 732

miscues resulting in a meaning change, only 72 (9.83 percent) of the expected text items were later used.

A large percentage of the meaning change miscues that occurred in the reading of passages from science, social studies, and mathematics were technical terms typically found within materials from those areas. Almost half of all the miscues that resulted in a change of meaning within the areas of science, social studies, and mathematics were items of a technical nature.

Table 4 about here.

Conclusions

1. Regardless of the content of reading material, readers make extensive use of syntactic and semantic cues in their encounter with each passage. The data of this and similar oral reading studies (Ohaver, 1971; Weber, 1968; Y. Goodman, 1967; and Allen, 1969) support the conclusion that readers not only use these cues, but will tend to correct their miscues in light of syntactic and semantic acceptability.
2. Regardless of the content of the reading material, readers make similar use of syntactic and semantic cues to gain meaning. The data here do not support the assumptive differences in reading materials in various content areas frequently described in professional references. The data herein reveals that the reading

process itself remains stable across passages from various content areas.

3. When passages from various content areas are controlled for readability, they present no significant differences that change the strategies used and the strengths demonstrated by readers. Since readability, as measured by the Fry formula, is in essence a control for syntactic and semantic difficulty, materials of similar readability would not necessitate shifts in reading strategies with regard to the content of the material.
4. Readers cannot retell a passage at a significantly higher level of syntactic complexity than that allowed by their comprehension of the stimulus passage. This confirms previous findings of significant relationships between patterns of language structure in written materials and ability to understand the intended meaning.
5. The syntactic complexity of initial retelling of passages, as measured by the number of T-units, appears to be influenced by variations in content areas.
6. When readers are asked to recall what they have read, the omission of words whose meanings were changed during the oral reading suggests the absence of an appropriate label for underlying concepts that have not been fully formed. Further unsuccessful attempts to elicit the recall of "meaning change" words by providing the subject with synonyms and definitions lend further credence to this conclusion. The data herein support the theory

that contextual associations allow the reader to "determine the semantic role of a word and further to recognize and comprehend it in the sentence" (Ruddell, 1969, p. 69).

Discussion

The fact that no significant differences were found among the selected passages as shown by the results of the RMI with regard to the hypotheses necessitates a critical re-examination of the assumptive literature dealing with reading in the content areas. Previous writings pointed to the need of readers to shift their "attack" strategies according to the content of reading materials. Certain materials are supposedly more difficult or require a unique set of skills needed to decode and comprehend the message. The findings here, however, suggest that the reading process remains stabilized across different content materials. Such evidence adds to the existing theoretical knowledge of reading as a psycholinguistic phenomenon.

The data herein reveal no significant variations in the readers' ability to generate miscues, many of which were corrected, that served the same grammatical function and that were grammatically and semantically acceptable. All readers made extensive and similar use of syntactic and semantic cues regardless of the passage content. The findings support the theories and models developed by researchers (Goodman & Goodman, 1977; Ruddell, 1970; Smith, 1973) who have described reading as a language process to which the reader contributes information from previous and intuitive

knowledge of language and reading. When such information coincides with the language patterns and experiences of the author, reading is a meaningful reconstruction of an encoded message. It is within this realm of reader-author interaction that difficulties in reading may exist.

This study tends to support the importance of parallel reader-author interaction as revealed by the syntactic complexity comparisons between the passages and the retellings. The syntactic complexity, as measured by words per T-unit, between the passages and the retellings for the four areas showed no significant differences. The results of the RMI also showed no significant difference in the comprehension profiles on each passage from the four areas. The patterns of language structure found in the passages and retellings, therefore, were assumed to be similar and thus had no significant effects that differentiate the comprehension profiles among science, social studies, or mathematics.

Although the syntactic complexity of the passages and the retellings were significantly different with regard to words per T-unit for literature, the differences did not affect the corresponding comprehension profiles in comparison to those in the other areas. One explanation for this discrepancy lies in the absence of technical vocabulary in the literature passages. Since comprehension is dependent upon understanding the deep structure of large units of meaning, the subjects probably were not concerned with individual word meaning as they may have been when confronted with technical terms in science, social studies, and mathematics.

A similar phenonmenon appears to exist in the subjects' ability to recall expected text items during an initial retelling or questioning session. The findings herein suggest that readers cannot produce an appropriate label for underlying concepts that have not been fully formed. Because comprehension is a function of the similarity of printed language to the oral language structure used by readers, such findings "may be interpreted to support the importance of contextual associations which provide sufficient delimiting information to enable a child to determine the semantic role of a word..." (Ruddell, 1965, p. 69). Samuels (in Ruddell, 1969, p. 69) also found that subjects had better comprehension when reading passages contained words of high association value. It then follows that subjects must have some degree of conceptual content in memory storage in order to produce appropriate labels and meanings for lexical items. Since "semantic skills are dependent upon the ability to find referents for abstract symbols..." (Svedman, 1970, p. 642), and since meaning is carried by the deep structure of language, information processing or recall cannot take place without the appropriate memory storage of items at their deep underlying structure. Researchers conclude that comprehension is highly dependent upon the deep structure of language and the storage of corresponding concepts in long-term memory (Kolers, 1970; Smith, 1978; Cooper, 1964; Langer, 1967; Ohaver, 1971). Since the subjects of this study recalled and produced less than ten percent of the miscues that

resulted in a change of meaning, further support of the notion that deep structure and memory govern one's ability to produce a surface structure appears evident.

Summary

Within the limitations of this study, it can be concluded that the process involved in reading for meaning remains stable across content areas. Since the primary focus has been upon recoding and language strategies involved in the process itself, generalizations beyond the studied population without regard to the additional cue systems available and to other sources of extraneous variability is restricted. It now appears crucial to re-examine the assumptive literature dealing with reading in content areas and to design and implement teaching and research strategies based upon valid psycholinguistic findings.

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Table 1

ANOVA: Words Per T-Unit among Retellings

Source of Variation	S.S.	d.f.	M.S.	F.
Between	958.347	19	50.439	
Within	1737.796	60		
Areas	119.189	3	39.729	1.399
Residual	1618.607	57	28.396	

Table 2

ANOVA: Number of T-Units Among Retellings

Source of Variation	S.S.	d.f.	M.S.	F.
Between	1768.233	19	93.064	
Within	3122.028	60		
Areas	1993.850	3	664.616	33.579*
Residual	1128.178	57	19.792	

*F .95 (3, 57) = 2.76

Table 3

$\underline{t}$-Test Comparisons: Passages and Retellings

Area	$\bar{X}$ for Passages	$\bar{X}$ for Retellings	$\underline{t}$
		Words Per T-Unit	
Science	11.78	11.53	-0.18
Social Studies	12.62	12.84	0.21
Mathematics	12.76	10.22	-1.43
Literature	14.25	12.28	-2.31*
		Number of T-Units	
Science	22.25	6.45	-13.59*
Social Studies	21.25	11.40	- 5.86*
Mathematics	21.25	3.95	-24.53*
Literature	17.00	12.35	_ 2.73*

*Significant at .05 level

Table 4

Meaning Change Miscues

Area	Total Miscues Resulting in Meaning Change	Percent of Total Words Used[a]	Number of Technical Vocabulary Miscues	Percent of Technical Vocabulary Miscues
Science	173	9.82	65	37.5
Social Studies	208	8.17	93	44.7
Mathematics	221	9.04	121	54.7
Literature	130	13.84	——	——
Total	732	——	279	——
Means	——	9.83	——	46.3

[a]Percent includes those miscues resulting in meaning change used in initial retelling and in the subsequent questioning session.